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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/785,991	02/26/2004	Sweechan J.H. Yang	YANG3167/EM	2670
23364	7590	08/22/2005	EXAMINER	
BACON & THOMAS, PLLC 625 SLATERS LANE FOURTH FLOOR ALEXANDRIA, VA 22314			FULK, STEVEN J	
			ART UNIT	PAPER NUMBER
			2891	

DATE MAILED: 08/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/785,991

Applicant(s)

YANG, SWEEHAN J.H.

Examiner

Steven J. Fulk

Art Unit

2891

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 February 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: In the heading "Detailed Description of the Preferred Embodiment", the word "Detailed" is misspelled.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heineck et al. '721.

The fourth embodiment of Heineck et al. (Figs 6A-6E) teaches a method for forming a shallow trench in a deep trench structure. Referring to Figure 6A, the deep trench structure has a substrate (1), a pad oxide layer (2) and pad nitride layer (3), a deep trench formed therein (5) and filled with polysilicon (20), a liner layer (500), and a polysilicon or amorphous silicon layer (300; col. 3, lines 30-37). The reference teaches the amorphous silicon layer is then implanted with nitrogen ions by tilt

implantation into partial regions of the layer (col. 6, lines 59-62), and the layer is oxidized to form a thinner oxide region in the portion of the amorphous silicon layer that was implanted with nitrogen ions and a thicker oxide region in the portion that was not implanted with nitrogen ions (col. 6, lines 63-67). Heineck et al. teaches the thinner portion of the oxide layer is then removed and thicker portion is partially removed, and the liner layer not covered by oxide is removed to expose the polysilicon (col. 7, lines 1-7).

The fourth embodiment of Heineck et al. teaches etching oxide out of the deep trench to form a shallow trench, but does not teach etching the exposed polysilicon to form a shallow trench. The fourth embodiment also does not teach removing the residual oxide layer and liner layer. The first embodiment of Heineck et al. (Figs 3A-3G) teaches a method of forming a shallow trench in a deep trench structure wherein a liner layer and an implanted, oxidized amorphous silicon layer are used as a mask to etch exposed polysilicon to form a shallow trench (col. 5, lines 25-27). The first embodiment also teaches the removal of the residual oxide layer and liner layer masks (col. 5, lines 40-41). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the steps of etching the polysilicon trench and removing the residual mask layers of the first embodiment in the method of making a shallow trench of the fourth embodiment in order to increase the contact area and lower the

resistance of the buried contacts that conventionally fill the shallow trenches formed in deep trenches, and also because of the applicant's admitted statement in the disclosure reciting that it is necessary to form a shallow trench in a deep trench structure filled with polysilicon for subsequent process.

Conclusion

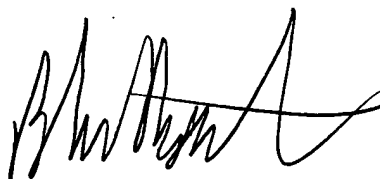
4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
 - a. Tews et al. '253 discloses a method of forming a shallow trench in a polysilicon filled deep trench wherein a thin layer of polysilicon is deposited over the polysilicon of the deep trench, the thin polysilicon layer is obliquely implanted with boron, arsenic or phosphorus to leave a corner of undoped poly, the doped polysilicon layer is oxidized and etched, leaving the undoped poly as an etch mask for a dry etch step to form a shallow trench (Figs 3-7).
 - b. Lee et al. '426 discloses a method of forming a shallow trench in a polysilicon filled deep trench wherein an ion implantation is performed to form a doped region in a predetermined depth of the trench and substrate, and a subsequent etching process removes a portion of the trench and substrate to form a shallow trench (Figs 3A-3C).

c. Goegel et al. '321 discloses a method of forming a shallow trench in a polysilicon filled deep trench wherein an oblique dry etch is performed to etch one side of the deep trench to form a shallow trench (Fig 4A-4G).

d. Ibok '682 and Soleimani et al. '920 disclose methods of controlling oxidation rates by implanting nitrogen ions.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven J. Fulk whose telephone number is (571) 272-8323. The examiner can normally be reached on Monday through Friday, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.



**B. WILLIAM BAUMEISTER
SUPERVISORY PATENT EXAMINER**

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

sjf
8/18/05